BUILDING ENERGY SIMULATION

For Users of EnergyPlus, VisualSPARK, DOE-2, BLAST, ENERGY-10, BDA, Genopt and their Derivatives

Users News

All the "Ask an EnergyPlus Expert" articles for 2004 may be found here, on the Publications page of our website.

Click here to download the newsletter's Cumulative Index.

EnergyPlus Version 1.2.1

To download a free copy of the program go to

http://www.energyplus.gov/

• • *Features of the New Release* • •

Datasets

- **Default fluid properties for water, ethylene glycol, and propylene glycol**
- **Example input files for all new features (more than 180 example files available)**
- **More than 100 new international weather locations in the EnergyPlus/ESP-r weather format (more than 680 locations worldwide).**

Geometry/Windows/Walls/Shading

- **Multi-sided polygons**

Daylighting

- **Skylight light wells**
- **Daylighting through interior windows**
- **Translucent Glass**

Zone Model

- **Improved displacement ventilation interaction with thermal mass**

COMIS Air Flow Calculation

- **Significant decrease in execution time**

Output

- **Ventilation load report**
- **Each zone defined as layer in DXF**
- **Advanced runtime variables can be requested**

HVAC

- **Plate heat exchanger component added to facilitate realistic configuration of hydronic systems**
- **Two- and four-pipe induction units**
- **Variable-speed fan-powered VAV reheat terminal units**
- **DOE-2.1E electric chiller model**
- **Dual setpoint controls for plant loop for water loop heat pump**
- **New water cooling coil (replaces simple coil) that is completely autosizable, options for wet/dry coil evaluation using cross- or counter-flow heat exchanger configurations**
- **Glycol concentrations can be specified**

Economics

- **Utility rate calculations**
- **Project construction cost estimating**

Utilities

- **Major updates to the IDFEditor including the ability to open multiple IDF files and copy/paste objects between files**
- **Major updates to EP-Launch including ability to select a group of simulations to run and maintain a history of simulations.**

Documentation

- **Input/Output Reference and Engineering Reference updated and extended for all new features and updates.**
- **More than 2,000 pages of documentation**

• • *And speed improvements throughout* • •

Ask An EnergyPlus Expert

TEMPERATURE CURVE

I'm simulating a building with no HVAC system. As there is no facility to input detailed ground temperatures, I've used monthly average temperatures. I observed a 5F Δ in the floor temperatures from the actual recorded data. Because of this, I think that the entire zone surface temperatures are slightly higher than expected. So I'm curious how much difference it would really make if I assigned a temperature curve (from actual data collected in the building) to the floor for a span of four days. Could somebody elaborate on how this could be done?

Answer
OtherSideCoefficients allows you to assign a schedule as the outside surface temperature for any surface.

1. In Surface:HeatTransfer, OutsideFaceEnvironment=OtherSideCoeff and OutsideFaceEnvironment Object="Scheduled Ground Temp" (or whatever name you choose).

2. Then add this object:

```
OtherSideCoefficients,

  Scheduled Ground Temp,   !- OtherSideCoeff Name
 -1, !- Combined convective/radiative film coefficient
  0, !- User selected Constant Temperature {C}
  1, !- Coefficient modifying the user selected constant temperature
  0, !- Coefficient modifying the external dry bulb temperature
  0, !- Coefficient modifying the ground temperature
  0, !- Coefficient modifying the wind speed term (s/m)
  0, !- Coefficient modifying the zone air temperature part of the equation
 Ground Temp Schedule;    !- ScheduleName for constant temperature
```

3. Create the appropriate "Ground Temp Schedule" objects.

4. Be sure to report the outside surface temperature to confirm the values are what you expect.

DESIGN DAYS

I simulated a building using design days. The air temperature (15C) in the zones on the north side of the building is much lower than the setpoint in winter (21.1C). However, the other three side zones meet the setpoint. Only when I increase the sizing factor from 1.3 to 1.8 do the temperatures of north side zones reach the setpoint.

Answer
This is a VAV system and all zones are meeting setpoint on the cooling design day. The north zones are not meeting setpoint on the heating design day because the VAV damper heating action is defaulting to NORMAL. In these zones, the heating design airflow rate is greater than the minimum supply fraction (0.3) times the cooling design airflow; therefore, in these zones, it is necessary to use REVERSE ACTION or supplement the heat with baseboard. We tested this case with all the zones set to REVERSE ACTION and the zone met setpoint on the winter design day.
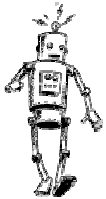
Ask An EnergyPlus Expert

COMIS -- AIRFLOW:OPENING

My windows are either fully opened or fully closed. So in COMIS AIRFLOW:Opening I set the numbers as follows:

Number of opening factors: 2

Opening factor #1: 0	Opening factor #2: 1
Discharge. coeff. for opening factor #1: 0	Discharge. coeff. for opening factor #2: 1
Width factor for opening factor #1: 0	Width factor for opening factor #2: 1
Height factor for opening factor #1: 0	Height factor for opening factor #2: 1
Start height factor for opening factor #1: 0	Start height factor for opening factor #2: 0

But with this setup I always get a severe error:

```
** Severe  ** &-WI:  *WI_0001_1: Cd is zero just in some lines!
************* It has to be zero in every line (Cd will be calculated)
************* or in no line.
** Severe  ** &-NET-LINks:  LinkNr: Srf_000039
************* Room depth has to be input with H/D/W option !
************* Otherwise Cd cannot be calculated!
```

When I change Discharge Coefficient for opening factor #1 to, let´s say, 0.1 the error goes away.
I don't think I understand the real meaning for these inputs from Input Output Reference.

Answer
This might clarify how the various inputs interact with each other.

1. The current implementation of COMIS in EnergyPlus requires that all COMIS AIR FLOW:OPENING Discharge Coefficients be >0. The Input Output Reference and the IDD incorrectly state that zero is a valid value.

2. When the window is closed, the "Air Mass Flow Coefficient When Window or Door Is Closed" and "Air Mass Flow Exponent When Window or Door Is Closed" are the primary factors specifying the flow rate at 1Pa along with crack length modifiers.

3. When venting is active, the "Window Open Factor for Ventilation" specified in COMIS SURFACE DATA specifies the opening factor to be used when the venting controls fully open this window. So, if this value is 0.5, then the window can never have an opening factor greater than 0.5.

4. If the venting controls modulate, the modulation is for opening factors from 0 to the value specified in 3 above.

5. If venting is active and modulating, as the modulation approaches zero, the values associated with Opening Factor #1 in the COMIS AIR FLOW:OPENING object (Discharge Coefficient, Width Factor, Height Factor, and Start Height) control the flow. When the venting controls completely close the window, it reverts to using the factors in 2.

Become An EnergyPlus Consultant

The EnergyPlus Consultants list is growing! If you would like to be listed as a consultant, send email to **klellington@lbl.gov**. Check out the consultants on our **website**.

Ask An EnergyPlus Expert

COMIS -- SUBSURFACE ON INTERZONE SURFACE

Do I need to define one interzone surface between two zones twice, as different surface names for each zone? Also, for heat transfer purposes, if I have a door on that interzone surface, does the door also need to be defined twice with different names for each of the two zones?

Answer
Yes -- interzone subsurfaces must be described twice, once in each zone. Then for COMIS, you attach a COMIS opening to one of these two instances of the subsurface. The subsurface that is attached to the COMIS opening then governs which zone is the controlling zone for the opening (if it has any operable vent controls).

WHERE IS VOLO VIEW EXPRESS?

Help! Autodesk no longer offers Volo View Express.

Answer

After Autodesk gave up Volo View, GARD Analytics, Inc., obtained permission to put on their web site.

You can still download a copy of Volo View Express 2.1 from http://www.gard.com/vve201setup.exe

COOLING COIL CONTROL

I am doing a sensitivity analysis with humidity control and have to set an appropriate range of the parameters related to the control of heating/cooling coils. Three parameters are in question:

1. Leaving relative humidity from cooling coil
2. Heating coil: Controller convergence tolerance
3. Cooling coil: Controller convergence tolerance

Are there references that give typical ranges of these parameters?

Answer
The controller convergence tolerance values are specific to EnergyPlus; you will not find any technical literature discussing them. The value here depends on the type of equipment you are using. Some tolerances are ΔC, some are fraction of load. The default values are reasonable, or you may choose to use smaller numbers. We would not use anything larger than the defaults.

Item 1 implies that you are using COIL:Water:SimpleCooling. Due to limitations in this model, it is being phased out. For a study focusing on humidity control, we would strongly recommend upgrading to EnergyPlus 1.2.1 and using the new COIL:Water:Cooling or using COIL:Water:DetailedFlatCooling.

Ask An EnergyPlus Expert

MODELING GLASS DOORS

I have roll-up bay doors with glass panes in its construction and wanted to model it as just a glass door. I was trying to enter data for the windows and glass doors into the field Surface:HeatTransfer:Sub and noticed it only gave me the options entered in the CONSTRUCTION field. Then I noticed that in the construction field I can only choose items entered in Materials:Regular; it won't let me choose from the glass materials I entered into Material:WindowGlass. Why can't I do this as in the 3zvent example?

Answer
All the types of materials that are present in your idf file should appear in the pull-down list for CONSTRUCTION layers. Predefined materials are available in various files in the DataSets folders.
In EnergyPlus 1.2.0, you must use a text file editor to open the dataset file and your idf file and then copy/paste from one to the other. In EnergyPlus 1.2.1 you can open both files in IDF editor and copy/paste between them.

COOLING AND HEATING RATES

I am simulating a building with walls, lights and some electrical material. There are no HVAC systems, chiller, etc. But I need to have as output the Purchased Cooling Rate and the Purchased Heating Rate. It is possible?

Answer
Yes, you can get just the cooling and heating rates without any HVAC systems. To do that, you use 'purchased air', 'purchased chilled water' and 'purchased hot water'. See several of the example files such as any of the ones beginning 'PurchasedAir...' in the \EnergyPlus\ExampleFiles directory. Purchased Air is discussed beginning on page 520 (page 548 of the PDF) of the Input Output Reference under Group - Zone Forced Air Units. Purchased:ChilledWater is on page 424 (page 452 of the PDF) and Purchased:HotWater is on page 425 (page 453 of the PDF). Purchased Heating/Cooling, etc. are often an option on many of the systems--search for 'purchased' in the Input Output Reference manual.

AIR FLOW, UNITARY SYSTEM

I am using the FURNACE:BLOWTHRU:HEATCOOL unitary system. Can I specify one flow rate for the cooling operation and a different flow rate for the heating operation? Or can this type of system only be specified at one flow rate?

Answer
FURNACE:BLOWTHRU:HEATCOOL operates with a single flow rate for both heating and cooling. You must model two systems, one for heating and one for cooling, to have different flow rates. Because a given zone may be served by only one AIR PRIMARY LOOP, the second system must be a piece of zone equipment, such as AIR CONDITIONER:WINDOW:CYCLING or UNIT HEATER.

Question
So, if I can't specify two flow rates for this system, is there another unitary system that I can use or do I have to create two separate systems, one for heating and one for cooling?

Answer
It depends on what you are trying to learn with your model. If you have unlimited purchased air capacity and set it to be the first priority, then the entire load will be met by purchased air and the other system will never operate. If you specify the baseboard system as first priority, the purchased air will pick up the remaining load.

Ask An EnergyPlus Expert

SIMPLE COOLING COIL WARNING

My model with simple cooling coil always returns the following warning message:

`Convergence failure Simple cooling coil, iteration limit exceeded`

I tried the autosize and used the recommended UA value, but it didn't help much.

Answer
This may be the result of a mismatch in the coil sizing inputs. Make sure that the coil UA and water flow rate are consistent with the air loop flow rate and load.

Note that COIL:Water:SimpleCooling will be eliminated in the next release of EnergyPlus, because there are some deficiencies in the model. We recommend that you use one of the other chilled water coil models, COIL:Water:DetailedFlatCooling or the new COIL:Water:Cooling.

AUTOSIZING

I have a question about the autosizing of the DX cooling coil. I have a one-zone building conditioned by a unitary system with DX cooling coil COIL:COOLING:BYPASSFACTOREMPIRICAL. I input the SHR of the cooling coil as 0.75. I asked EnergyPlus to do the autosizing of the component wherever possible and I got a severe error message:

`** Severe  **`
`For object = COIL:DX:COOLINGBYPASSFACTOREMPIRICAL, name = "ROOFTOPUNIT_Z_SINGLE`
`COOLING COIL", the combination of rated air volume flow rate, total cooling`
`capacity and sensible heat ratio yields coil exiting air conditions above the`
`saturation curve. Possible fixes are to reduce the rated total cooling capacity,`
`increase the rated air volume flow rate, or reduce the rated sensible heat ratio`
`for this coil.`

Then I reduced the coil SHR to 0.74 and it worked.

Also, I have a thermostat object for this zone but I do not have a humidistat object. My understanding is that EnergyPlus will autosize the cooling coil in order to meet the thermostat setpoint and leave the indoor humidity as whatever it is. But is this really the case? I am wondering if anyone can give me some explanation of this.

Answer
The error message occurred because the specified SHR could not possibly be achieved for air at the autosized flow rate entering at ARI rated conditions and being cooled at the autosized capacity, which was determined by the specified supply air temperature in the sizing objects.

The easiest approach in this case is to autosize all three values (capacity, air flow rate, and rated SHR).
The last line of the error states this:
`"If autosizing, it is recommended that all three of these values be autosized."`

You are correct that the DX coil is sized to meet the sensible load without providing any active humidity control. However, the coil will do latent cooling, and it cannot do less latent cooling than psychrometrics would allow.

EnergyPlus Version 1.2.1

To download a free copy of the program go to
www.energyplus.gov

EnergyPlus is an R&D 100 Award Winner, named one of the 100 most technologically significant new products of the year.

EnergyPlus Support Tools

Support software is listed on our website (http://SimulationResearch.lbl.gov/EP/ep_tools.html) and in Section 2 of this newsletter.

EnergyPlus Weather Data from www.energyplus.gov/

There are 275 locations in the United States, 16 California thermal zones, 55 Canadian locations, and 233 international locations in more than 80 countries.

Ask an EnergyPlus Expert

Questions from EnergyPlus users are answered promptly via email by program developers. To submit questions, join the EnergyPlus User Group at http://groups.yahoo.com/group/EnergyPlus_Support/.
A selection of questions/answers are compiled (yearly) into a downloadable PDF document:
Q and A for 2002, Q and A for 2003, Q and A for 2004.

EnergyPlus Validation – go to http://www.eere.energy.gov/buildings/energyplus/testing.html

Need VoloView?? – go to http://www.gard.com/experienced_modeler_intro.htm

Are you an EnergyPlus Consultant ?

If you are engaged in EnergyPlus consulting, and would like to be listed in the *Building Energy Simulation User News* and on our website (http://SimulationResearch.lbl.gov), please send details to klellington@lbl.gov.

Join the EnergyPlus User Group

The developers of EnergyPlus have formed a support group to foster discussion and maintain an archive of information for program Users. We invite questions about program usage and suggestions for improvement to the code. Go to http://groups.yahoo.com/group/EnergyPlus_Support/

Translate EnergyPlus Web Pages

A new link on the main EnergyPlus web page (www.energyplus.gov/) allows you to view the pages in any of eight languages. Unfortunately, the translator doesn't work with PDF files. Look for the fish at the bottom of the web page. Pages may be translated into Chinese, French, German, Italian, Japanese, Korean, Portuguese and Spanish.

New Beta Release of

DesignBuilder

Mission: "To provide state-of-the-art building modeling tools in a package accessible to all."

Dr. Andy Tindale
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Visualisation and shading

Summary

DesignBuilder is a *unique software tool* for assessing and creating building designs. It provides a range of environmental performance data such as: annual energy consumption, maximum summertime temperatures and HVAC component sizes. The software can be used effectively at any stage of the design process from the conceptual stage where you may want to try out some façade options on a single room, through to production. This new beta release is a significant improvement on previous publicly available versions (0.3.x and 0.4.10) and is much closer in functionality and appearance to the first production release which will be ready in early 2005.
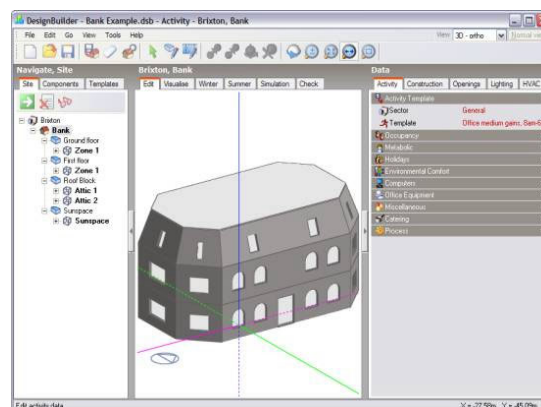
Interface to EnergyPlus

DesignBuilder 0.6 provides an easy-to-use yet powerful interface to most of the EnergyPlus envelope, solar, ventilation and daylighting capabilities as well as heating and cooling load modelling. It uses the latest EnergyPlus version 1.2.1 simulation engine to generate its data. The software comes with summer and winter design data for over 1400 locations and access to over 500 hourly simulation weather files

Its Easy To Use

In addition to wizards, data templates allow you to load common building geometries, constructions, usage patterns, HVAC & lighting systems into your design. You can also add your own templates if you often work on similar types of buildings. The integration of the 3D rendered view with performance data helps you to understand the trade-off between architectural and other practical issues such as overheating.

Wizards guide you through the process of entering design data, analyzing it and producing reports.

New Features based on EnergyPlus 1.2.1

* Faster simulation because surfaces with more than four sides are modeled without triangulation, faster solar initialization and faster COMIS solution.
* Undo/redo option for geometric operations
* External and internal surface editing - user definable windows, doors, vents and openings
* Sloping walls
* More control options for COMIS natural ventilation modeling
* Ability to save components to library
* Improved stability

Wish List for DesignBuilder in the Future

To be included before version 1
* Tools for block geometry editing
* Undo and redo of model attributes
* Design bookmarks to allow comparison of design options
* Report generation and printing
* Online Help
* UK Part L2 building regulations compliance checking

Features in the pipeline (probably for version 1.1)
* More HVAC systems
* CAD interface (DXF import,...)
* Visualization walk-through and animated output

And looking further ahead, major features planned (probably for version 2.0)
* CFD simulation
* Interface to a wider range of EnergyPlus HVAC systems
* Admittance calculation method
* High speed simulation

A full list of current features can be found at:

http://www.designbuilder.co.uk/products/Features.htm

For background information, please refer to the original announcement of the DesignBuilder software in Vol. 25, No. 1 of the *Building Energy Simulation User News.*

SPARK is an equation-based simulation environment that allows you to build customized models of complex physical processes by connecting calculation objects that represent system components like walls, fans, heat exchangers, chillers, ducts, mixing boxes, controls, etc. It is aimed at the simulation of innovative and/or complex building systems that are beyond the scope of whole-building programs like DOE-2 and EnergyPlus. VisualSPARK adds a graphical user interface to SPARK to simplify its use.

Download VisualSPARK free of charge from

http://simulationresearch.lbl.gov/

Please go to our website to download new VisualSPARK documentation:

- **New Features, Bug Fixes, and Changes**
- **Frequently Asked Questions**
- **How To Port Atomic Classes To SPARK 2.*x***
- **Theoretical Speed-Up Using SPARK**

SPARK was developed by the Simulation Research Group at Lawrence Berkeley National Laboratory and by Ayres Sowell Associates, with Support from the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technologies Program of the U.S. Department of Energy, Program Manager Dru Crawley.

The Forecast Looks Favorable for …

(Free!) Weather Data on Demand

You can access archived weather data from around the world through this U.S. DOE web interface:

www.eere.energy.gov/buildings/energyplus/cfm/weatherdata/weather_request.cfm

Hourly weather data is continuously collected and stored into a local database, available through this web interface. Most stations have information for dry bulb temperature, wet bulb temperature, wind speed/direction, atmospheric pressure, visibility, cloud conditions, and precipitation type.
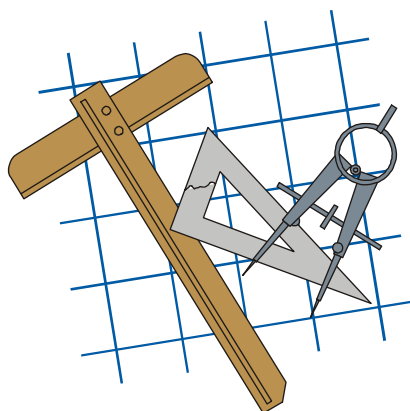
Building Energy Tools Directory

The web-based Building Energy Tools Directory contains information on more than 270 building-related software tools from around the world.

For each tool in the directory, a short description is provided, along with information about technical expertise required, users, audience, input, output, validation, computer platforms, programming language, strengths, weaknesses, technical contact, availability and cost. A link is also provided for directly translating the web pages into more than eight languages.

Know of a tool (yours?) that isn't in the directory? Visit http://www.eere.energy.gov/buildings/tools_directory/your_software_here.html or contact Dru Crawley at Drury.Crawley@ee.doe.gov.

Recently, a user posted a request to the BLDG-SIM (to subscribe, send email to BLDG-SIM-SUBSCRIBE@gard.com*) newsgroup that he needed a tool to analyze the performance of sun shading elements on the facade of a large commercial building. He was directed to the Building Tools Directory at* www.energytoolsdirectory.gov *for software that deals specifically with sun shading elements:*

|			
Awnshade	*http://www.fsec.ucf.edu/*	*Solar Tool*	*http://www.squ1.com/*
LESO-SHADE	*http://lesowww.epfl.ch/*	*Sombrero*	*http://nesa1.uni-siegen.de/*
Overhang	*http://www.susdesign.com/*	*SUN_CHART*	*http://www.srv.net/opt/sunchrt.html*
ShadowFX	*http://www.shadowfx.co.uk/*	*Suncast*	*http://www.ies4d.com/*
SUNDI	*http://emsolar.ee.tu-berlin.de/simulation/sundi.html*		

More introductory information on each tool is given in the Tools Directory.

FREE Membership in in IBPSA-USA *!!!*

International Building Performance Simulation Association USA Affiliate

The IBPSA-USA Board of Directors has waived the annual membership fee for 2003 so joining IBPSA is easier than ever. If you want to become a member, send an email with your name, company, mailing and email address, and phone and fax numbers to Rick Strand to r-strand@uiuc.edu. You will receive a confirmation email to indicate that you have been accepted for membership. Free Membership for USA Affiliates only.

www.ibpsa.org
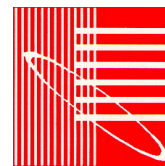
Recent Reports

These reports are available from the Simulation Research Group at Lawrence Berkeley National Laboratory.

download pdf document

Thermal Characteristics of High Thermal Mass Passive Solar Buildings

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Abstract
Thermal behavior of a high thermal mass residential building with a conservatory located in Hockerton, U.K was studied using both the SUNREL and EnergyPlus building energy simulation software. The building was designed to operate with no conventional space heating during the winter. Measured air temperatures of the inside rooms of the building show a steady value throughout the year with minimal diurnal temperature swings. Simulation results from both software indicate that the accuracy of the predicted zone air temperatures depends on inter zone solar transfer through transparent surfaces. SUNREL does not explicitly calculate solar transfer between zones. As such, predicted air temperatures of the zones that do not possess external fenestration largely depend on user-defined solar transfer fractions. Although EnergyPlus has a detailed distribution model, it treats the inter-zone solar transfer as diffuse radiation. This tends to underestimate the internal air temperatures in colder months and overestimates the same in the warmer months. Depending on the massiveness of the building, annual simulations have to be carried out for a period longer than a year using the same weather data to account for the thermal energy accumulation in the initial period of the simulation

download pdf document　　　　　　　　　　　　　　　*Energy and Buildings 36 (2004) 481–494*

Improving Building Design and Operation of a Thai Buddhist Temple

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Abstract
In this paper we report the results of coupled DOE-2 and 3D transient computational fluid dynamics (CFD) simulations for an unconditioned 100-year-old Buddhist temple, located in an urban area of Bangkok, Thailand. The HEATX CFD code was combined with the DOE-2 thermal simulation program, to analyze the heat transfer and airflow performance of the building. The indoor temperatures simulated by both programs were validated with measured temperature taken at the site. The simulation indicated poor thermal comfort conditions in this temple. The transient CFD/DOE-2 simulation suggested several remedial changes that could be implemented to improve the indoor comfort. In addition, a prototype building that combined several improved design options was proposed, and the simulation of the prototype was then performed. The result indicated an improvement of the indoor thermal comfort compared with that of the current building.
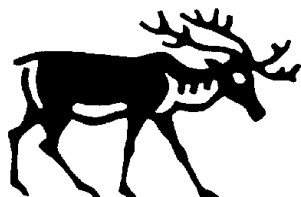
DOE-2

DOE-2.1E (v. 121) 1,000-Zone version for Windows from ESTSC; other vendors of DOE-2 based programs are listed on our website: http://SimulationResearch.lbl.gov/.

Cost is as follows:
$ 300 U.S. Government/Non-Profits/Education
$ 575 U.S. Public, Mexico, Canada
$1129 to $1268 Other Foreign

DOE-2 Documentation on a CD from ESTSC - Cost US$100

What is included on the CD?

- DOE-2 Reference Manual (Part 1)
- DOE-2 Reference Manual (Part 2)
- DOE-2 Supplement to the Reference Manual (2.1E)
- DOE-2 BDL Summary (2.1E)
- DOE-2 Engineers Manual (2.1A)

Order Software and ESTSC Documentation

Ed Kidd or Kim Buckner
NCI Information Systems, Inc.
Energy Science and Technology Software Center (ESTSC)
P.O. Box 1020
Oak Ridge, TN 37831

Phone: 865/576-1037
Fax: 865/576-6436
Email: estsc@adonis.osti.gov

Purchase DOE-2 Documentation

DOE-2 Sample Run Book (2.1E) -- The Sample Run book is the only remaining DOE-2 manual not available electronically. It must be purchased separately from NTIS; ordering information may be found at http://SimulationResearch.lbl.gov > DOE-2 > Documentation

Free DOE-2 Documentation (http://simulationresearch.lbl.gov/> DOE-2 > Documentation)

DOE-2 Basics Manual (2.1E)

Update Packages: Update Packages are **not** cumulative; each one contains different information.
Download all four packages then print and insert the pages into your existing DOE-2 manuals.
- Update Package #1: DOE-2.1E Basics, the Supplement and BDL Summary
- Update Package #2: BDL Summary and Supplement.
- Update Package #3: Appendix A of the Supplement.
- Update Package #4: (1000-zone DOE-2.1E) BDL Summary.

DOE-2 Modeling Tips (pdf files) for **2002**, for **2003**, for **2004**
A yearly compilation of all the "how to" and "DOE-2 Puzzler" articles from the *Building Energy Simulation User News.*

Changes and Bug Fixes to DOE-2.1E (txt file)
Description of all changes and bug fixes in a text document.

DOE-2 listings are continued on the next page

DOE-2 (continued)

DOE-2 Training

Private or group DOE-2 courses for beginning and advanced users.
Contact Marlin Addison at (602) 968-2040, marlin.addison@doe2.com

DOE-2 Help Desk

Email (klellington@lbl.gov) or fax the Simulation Research Group with your questions. Fax: (510) 486-4089

How is Height Determined for Wind-Speed Modification in DOE-2?

The
DOE-2
Puzzler

How is the space height is determined for calculating the effective wind velocities for computing infiltration and exterior film coefficients. Page 2.88 of the Supplement says that the SPACE keywords Z, VOLUME, and AREA are used. So what happens if you don't use Z, but do have wall heights and volumes and areas? Does it still get the right clues? Our question is how can I give DOE-2 the best handle on heights for spaces to do these calculations most appropriately?

For instance, what would tell DOE-2 that this attic's roof is at a 8 ft plus height?

```
$--- ATTIC/ROOF ZONE ---$
ATTIC-1 =SPACE          A = 1200.00 V = 2419.94 FLOOR-WEIGHT = 0
                        INF-METHOD = S-G
                        FRAC-LEAK-AREA = ATVENTA
                        ZONE-TYPE = UNCONDITIONED T=(TAVE TIMES 1.1) ..

$ROOF DIMENSIONS GO HERE...$
FRONT-RF-1 = ROOF        H = 31.18 W = 18.25 AZ = 180  TILT = 18.40
                        CONS = INS-RF-1 OUTSIDE-EMISS = 0.90 ..
FRONT-RF-1F = ROOF       H = 3.46 W= 18.25 AZ = 180  TILT = 18.40
                        CONS = INS-RF-1F OUTSIDE-EMISS = 0.90 ..
GABLE-1    = ROOF        H = 5.76 W = 17.32 AZ = 90  TILT = 90.00
                        CONS = NONINS-WL ..

REAR-RF-1  = ROOF        LIKE FRONT-RF-1  AZ = 0 ..
REAR-RF-1F = ROOF        LIKE FRONT-RF-1F AZ = 0 ..
GABLE-2    = ROOF        H = 5.76 W = 17.32 AZ = 270  TILT = 90.00
                        CONS = NONINS-WL ..
```

And that this living zone space has an 8 ft height?

```
$---MAIN CONDITIONED ZONE---$
HOUSE-1    = SPACE    A = FLRAREA
                     V = FLRAREA TIMES 8.00
                     S-C = COND-1 ..
```

DOE-2 Puzzler continued …

```
$--- WALLS ---$
$ THE FRAMING AND NON-FRAMING FACTORS ARE MULTIPLIED BY THE WALL DIMENSIONS$
WALL1-1  =E-W         H=8.00  W=35.00  AZ=0   CONS=INS-WL-FWI-1 ..
DOOR-1-1     =DOOR           H=6.67  W=1.50  CONS=DR-CONS-1 ..
WIN-1-1      =WI             H=4.00  W=20.09 Y=2.67 G-T=GT_WIN-1
OVERHANG-A = 7.46  OVERHANG-B = 0.00  OVERHANG-W = 35.00  OVERHANG-D = 0.00
OVERHANG-ANGLE = 90  SETBACK = 0.33  S-SCH = FENS-1 ..

WALL2-1  =E-W         H=8.00  W=35.00  AZ=90  CONS=INS-WL-FWI-2 ..
DOOR-2-1     =DOOR           H=6.67  W=1.50  CONS=DR-CONS-1 ..
WIN-2-1      =WI             H=4.00  W=20.09 Y=2.67 G-T=GT_WIN-1
OVERHANG-A = 7.46  OVERHANG-B = 0.00  OVERHANG-W = 35.00  OVERHANG-D = 0.00
OVERHANG-ANGLE = 90  SETBACK = 0.33  S-SCH = FENS-1 ..

WALL3-1  =E-W         H=8.00  W=35.00  AZ=180  CONS=INS-WL-FWI-3 ..
DOOR-3-1     =DOOR           H=6.67  W=1.50  CONS=DR-CONS-1 ..
WIN-3-1      =WI             H=4.00  W=20.09 Y=2.67 G-T=GT_WIN-1
OVERHANG-A = 7.46  OVERHANG-B = 0.00  OVERHANG-W = 35.00  OVERHANG-D = 0.00
OVERHANG-ANGLE = 90  SETBACK = 0.33  S-SCH = FENS-1 ..

WALL4-1  =E-W         H=8.00  W=35.00  AZ=270  CONS=INS-WL-FWI-4 ..
DOOR-4-1     =DOOR           H=6.67  W=1.50  CONS=DR-CONS-1 ..
WIN-4-1      =WI             H=4.00  W=20.09 Y=2.67 G-T=GT_WIN-1
OVERHANG-A = 7.46  OVERHANG-B = 0.00  OVERHANG-W = 35.00  OVERHANG-D = 0.00
OVERHANG-ANGLE = 90  SETBACK = 0.33  S-SCH = FENS-1 ..

$-- CEILING HAS 15% FRAMING FACTOR, 10% RAFTERS OTHER IS R. CANS/ BOXES ETC--$
CEIL-1 = INTERIOR-WALL     TILT=0 CONS= CEIL-INS-1 AREA = CLNFRF TIMES 1200.00
                           NEXT-TO= ATTIC-1 ..
```

Answer

The wind-speed from the weather tape is multiplied by a correction factor <WSTMUL>.

```
<WSTMUL> = (TP1*(BLDHT)/32.8)**TP2) / (WSTP1*(WSHGT/32.8)**WSTP2)

BLDHT = <ZZ> + <ZVOL> / <ZFLRAR>
```

where

```
TP1 is DOE2 command, keyword: BUILDING-LOCATION, TERRAIN-PAR1
TP2 is DOE2 command, keyword: BUILDING-LOCATION, TERRAIN-PAR2
WSTP1 is DOE2 command, keyword: BUILDING-LOCATION, WS-TERRAIN-PAR1
WSTP2 is DOE2 command, keyword: BUILDING-LOCATION, WS-TERRAIN-PAR2
WSHGT is DOE2 command, keyword: BUILDING-LOCATION, WS-HEIGHT or WS-HEIGHT-LIST
<ZZ> is DOE2 command, keyword: SPACE, Z
<ZVOL> is DOE2 command, keyword: SPACE, VOLUME
<ZFLRAR> is DOE2 command, keyword: SPACE, AREA
```
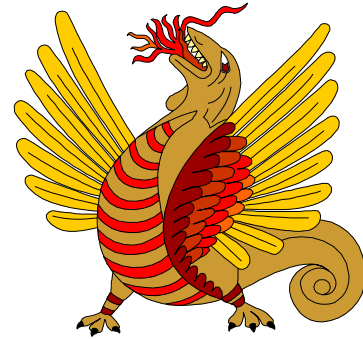
So DOE-2 does not use wall heights (or Zs) in calculating the local wind-speed. For a multi-story building it is important to use the SPACE Z in the input in order to get the right correction factor.

Run for safety, foolish pedestrians!

Building Energy Software

from the Environmental Energy Technologies Division of Lawrence Berkeley Laboratory

Free Downloads	
BDA 3.0 (Building Design Advisor) (building decision-making from design through completion)	**gaia.lbl.gov/BDA**
COMIS (multi-zone air flow and contaminant transport model)	**www-epb.lbl.gov/comis**
EnergyPlus 1.2.1 (new-generation whole-building energy analysis program, based on BLAST and DOE-2)	**www.energyplus.gov/**
GenOpt® 2.0 (generic optimization program)	**SimulationResearch.lbl.gov**
Optics 5.1.02 (for analyzing optical properties of glazing systems)	**windows.lbl.gov/materials/optics5/**
RADIANCE 3.5 (analysis and visualization of lighting in design)	**radsite.lbl.gov/radiance/**
Desktop Radiance 2.0β (integrates the Radiance Synthetic Imaging System with AutoCAD Release 14)	**radsite.lbl.gov/deskrad/**
Radiance Control Panel (automates some Radiance tasks once the model has been created)	**www.squ1.com/site.html**
THERM 5.2 (models two-dimensional heat-transfer effects in building components where thermal bridges are of concern)	**windows.lbl.gov/software/therm/therm.html**
VisualSPARK 2.0 (Simulation Problem Analysis and Research Kernel) (connect component models to simulate innovative building envelope and HVAC systems)	**SimulationResearch.lbl.gov**
WINDOW 5.2 (thermal analysis of window products)	**windows.lbl.gov/software/window/window.html**
Free Software / Request by Fax from 510.486.4089	
RESFEN 3.1 (choose energy-efficient, cost-effective windows for a given residential application)	**windows.lbl.gov/software/resfen/resfen.html**
Web Based (free)	

Home Energy Saver (quickly computes home energy use)
     and
 Home Improvement Tool (simplified Home Energy Saver)
	hes.lbl.gov
	     and
	 hit.lbl.gov

BLAST*news*

www.bso.uiuc.edu

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The **Building Loads Analysis and System Thermodynamics (BLAST** program predicts energy consumption, energy system performance and cost for new or existing (pre-retrofit) buildings.

BLAST contains three major sub-programs:

- **Space Load Prediction** computes hourly space loads in a building based on weather data and user inputs detailing the building construction and operation.

- **Air Distribution System Simulation** uses the computed space loads, weather data, and user inputs.

- **Central Plant Simulation** computes monthly and annual fuel and electrical power consumption.

Heat Balance Loads Calculator (HBLC)
The BLAST graphical interface (HBLC) is a Windows-based interactive program for producing

BLAST input files. You can download a demo version of HBLC (for MS Windows) from the BLAST web site (User manual included).

HBLC/BLAST Training Courses
Experience with the HBLC and the BLAST family of programs has shown that new users can benefit from a session of structured training with the software. The Building Systems Laboratory offers such training courses on an as needed basis typically at our offices in Urbana, Illinois.

WINLCCID 98
LCCID (Life Cycle Cost in Design) was developed to perform Life Cycle Cost Analyses (LCCA) for the Department of Defense and their contractors.

To order BLAST-related products, contact the Building Systems Laboratory at the address above.

Program Name	Order Number	Price
PC BLAST Includes: BLAST, HBLC, BTEXT, WIFE, CHILLER, Report Writer, Report Writer File Generator, Comfort Report program, Weather File Reporting Program, Control Profile Macros for Lotus or Symphony, and the Design Week Program. The single CD-ROM includes soft copies of the BLAST Manual, technical articles and theses related to BLAST, nearly 400 processed weather files with a browsing engine, and complete source code for BLAST, HBLC, etc.	3B486E3-0898	$1500
PC BLAST Package Upgrade from level 295+	4B486E3-0898	$450
WINLCCID 98: executable version for 386/486/Pentium	3LCC3-0898	$295
WINLCCID 98: update from WINLCCID 97	4LCC3-0898	$195

The last four digits of the catalog number indicate the month and year the item was released or published. This will enable you to see if you have the most recent version. All software will be shipped on 3.5" high density floppy disks unless noted otherwise.
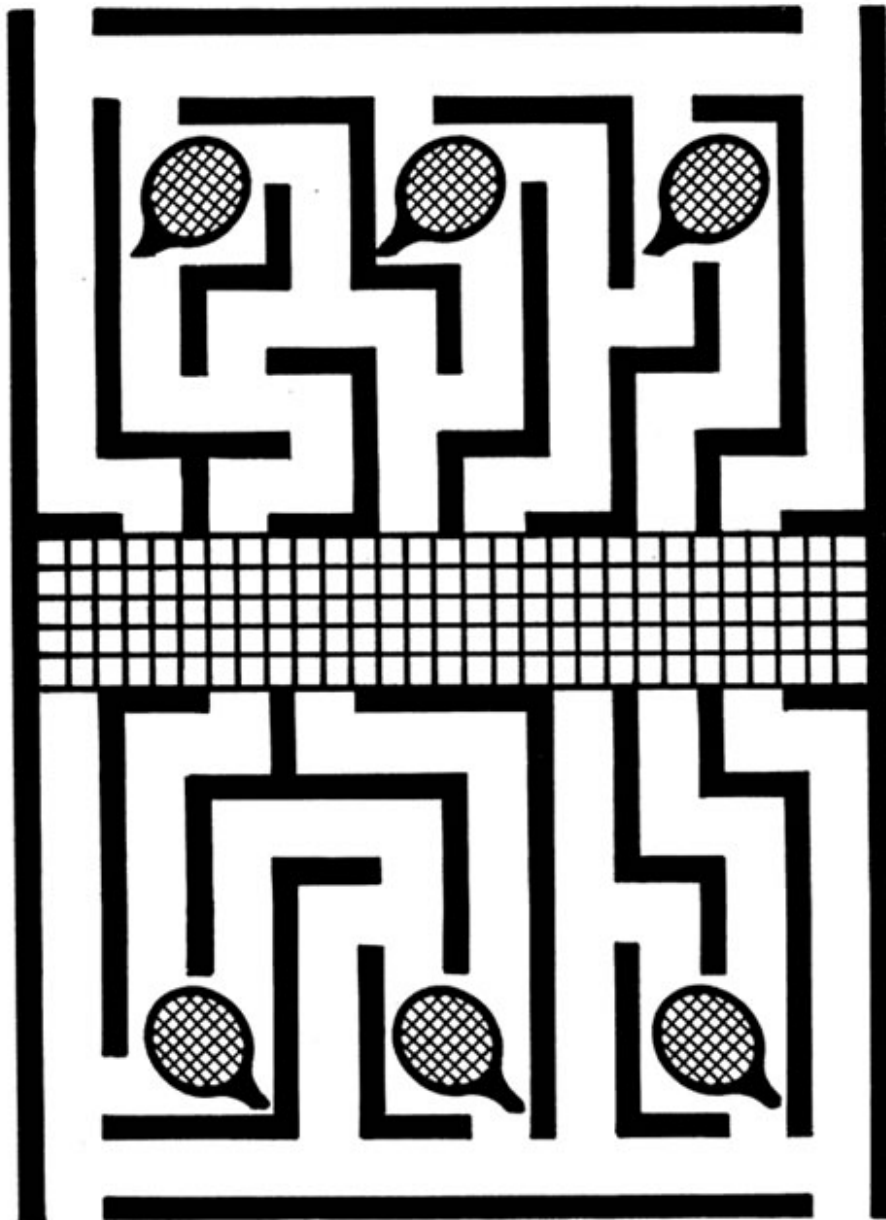
It's The "Tennis Anyone??" Maze

TENNIS

Enter the maze, pass through all rackets, then exit the maze without using any path more than once. You must cross the net without crossing your path after each racket.

For the solution, see Section 2 of this newsletter